Chicago Climate Exchange®

Sustainably Managed Rangeland Soil Carbon Sequestration Offset Project Protocol

Agricultural Best Management Practices – Sustainably Managed Rangeland Soil Carbon Sequestration Projects

The Chicago Climate Exchange (CCX®) Agricultural Best Management Practices – Sustainably Managed Rangeland Soil Carbon Sequestration Offset Project Protocol outlines the process and requirements for Project Proponents to register greenhouse gas emission reductions resulting from the voluntary sequestration of carbon in rangeland soils. CCX General Offsets Program Provisions, CCX Offset Project Verification Guidance and CCX Offset Project Protocols can be downloaded by visiting www.theccx.com. Requests for further information or comments may be directed to offsets@theccx.com.

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Chicago Climate Exchange Offset Project Protocol

Agricultural Best Management Practices – Sustainably Managed Rangeland Soil Carbon Sequestration Offset Projects

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ACRONYMS

ANSI	American National Standards Institute
CCX	Chicago Climate Exchange
ESD	Ecological Site Description
IPCC	Intergovernmental Panel on Climate Change
LRR	Land Resource Region
NDMC	National Drought Monitoring Center
NRCS	Natural Resources Conservation Service
SPI	Standardized Precipitation Index
USDA	United States Department of Agriculture

1. INTRODUCTION

Chicago Climate Exchange (CCX) is the world's first and North America's only active voluntary, legally binding integrated trading system to reduce emissions of all six major greenhouse gases (GHGs), with Offset Projects worldwide. CCX Members with significant GHG emissions voluntarily enter into a legally binding agreement to reach CCX GHG Emission Reduction Commitment[1]. Upon enrollment with CCX, Exchange Allowances are issued to Members in amounts equal to their emission reduction targets. CCX Offsets are issued to Owners or Aggregators of registered Projects on the basis of verified sequestration, destruction or reduction of GHG emissions not included under the CCX Emission Reduction Commitment. Members are required to turn in the amount of Exchange Allowances and/or Offsets equal their actual GHG emissions annually.

CCX strives to promote transparency and integrity in the carbon market. In accordance with this goal, in developing this document, CCX was guided by the fundamental principles of Project GHG accounting outlined in ISO 14064-2: *Specification with guidance at the Project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancem*ents, Version 1. These principles include:

- Relevance
- Completeness
- Consistency
- Accuracy
- Transparency
- Conservativeness

The following sections discuss the Project criteria, boundaries, monitoring requirements, emissions reduction calculations and other Protocols that each Project Proponent must adhere to in order to generate Offsets from voluntary sequestration of carbon in Sustainably Managed Rangeland Offset Projects.

2. GENERAL PROVISIONS

All Offset Project eligibility is subject to the CCX General Offset Program Provisions and CCX Offset Project Protocol for Agricultural Best Management Practices – Sustainably Managed Rangeland Soil Carbon Sequestration Offset Projects, and the determinations of

[1] http://theccx.com/content.jsf?id=72

the CCX Committee on Offsets. All Project Proponents should review CCX General Offset Program Provisions, the Verification Guidance Document and this Protocol.

3. ASSOCIATED DOCUMENTS

This Protocol references the use of several associated documents. These documents include:

- CCX General Offset Program Provisions
- CCX General Verification Guidance Document
- CCX Project Implementation Document (PID)
- CCX Project Specific Conflict of Interest Form
- CCX Greenhouse Gas Emission Factors Document
- CCX Project Owner Attestation

These documents are available on the Offsets section of the CCX website: www.theccx.com.

4. PROJECT DEFINITION

A Sustainably Managed Rangeland Soil Carbon Sequestration Offset Project consists of a long term, legally binding commitment to defined management practices which increase soil carbon stocks on Rangelands in specific geographic areas. A Project consists of the adoption of a forward looking, documented plan which includes a minimum five year commitment to manage Rangeland for increased soil carbon storage through practices that identify and accommodate periods of grazing, ensure sustainable forage-animal balance such that forage produced meets demand of livestock and/or wildlife and provides for a contingency plan for management under drought conditions.

5. ELIGIBILITY CRITERIA

Several factors determine a Project's eligibility for generating Offsets including the Proponent's membership status, ownership status, Project start date, location and whether the Project meets the CCX performance benchmark. Project Proponents must submit the CCX Project Implementation Document (PID) for review and determination of eligibility.

5.1 CCX Membership

The Project Proponent(s) must be a Member or Participant Member (Offset Provider or Aggregator) of CCX. An Aggregator serves as an administrative representative, on behalf of Project Owners, of one or more projects. Project Proponents should contact CCX directly for membership rules and information.

5.2 Eligibility Governing Entities with Minor Emissions

Entities with an emissions profile greater than 10,000 metric tons CO_2 equivalent for the most recent calendar year may register and trade CCX Offsets only if the entity is a Member of CCX and undertakes the CCX emission reduction commitment. For specific guidance on this provision, Project Proponents should review the General Provisions of the CCX Offsets program.

Entities who are unsure of their emissions profile should estimate their direct CO_2 emission using well accepted methodologies such as those available at the World Resources Institute (WRI)/World Business Council on Sustainable Development (WBCSD). CCX requires that all entities that are not Members, including producers enrolled with Aggregators, provide an attestation relating to their direct emissions in a form provided by CCX.

5.3 Ownership and Control

The Project Owner (e.g. the rancher) shall demonstrate clear ownership of the increase in soil carbon associated with the Project in order to register the Offsets with CCX. The attestation of Project Ownership will serve this purpose.

For pooled Projects, the attestation of Project Ownership must be included within the contract between the Project Owner and the Aggregator. For non-pooled Projects the proponent must provide evidence of Project Ownership to the Verifier. This evidence may include title, deed, tax records and/or a lease.

Leased land may be enrolled provided that the Project Owner has decision making authority on the land and the management practices specified herein are not a lease condition. Where a lease is silent on soil carbon and the practices required by this protocol are not a lease condition, ownership shall reside with the entity with operational control of the land. A land owner or lessor may enroll land they own but don't manage; provided they have stipulated practices required by this protocol as a lease condition and have secured provisions for compliance (e.g. access for verification, reporting of records to the aggregator, etc.).

5.3.1 Land Acquisition and Disposition and Leases

A lease agreement need not be for the term of the Project but the Project Owner, and/or Aggregator, assumes responsibility for any loss of operational control of the land and subsequent return of issued Offsets. Similarly, where land is sold and not continued in the CCX program and the term of Project has not been completed, all Offsets earned by the Project shall be returned and/or replaced and cancelled.

Enrolled lands must be under the management and control of the Project Owner for the entirety of the growing season. Lands purchased during the growing season may not receive offsets for that year but may enroll for future years.

5.3.2 Required Contract Conditions for Aggregated Projects

An Aggregator serves as an administrative representative, on behalf of Project Owners, of multiple CCX-qualifying Offset Projects. Offset Aggregators are responsible for maintaining a database of Project participant records. In addition, contracts signed between Aggregators and Project Owner(s) must stipulate the following conditions that the Project Owner will adhere to (described in detail in the Protocol):

- A continuous 5 year forward commitment to the practices specified in this Protocol.
- A declaration that the Project Owner has ownership or operational control of the land enrolled as the Rangeland soil carbon management Project. Where land is leased and the lessee shall sign the declaration indicating that they have operational control and the practices specified by the Protocol are not a lease condition.
- A declaration that the carbon rights are exclusively being sold through that Aggregator on CCX (i.e., they are not being sold through another registry, program, or through another Aggregator on CCX, or other).
- A declaration that the Project Owner is enrolling all owned or controlled Rangeland that is within an eligible LRR.
- A declaration by the Project Owner that they have read and understand the CCX Rangeland Soil Carbon Project Protocol and will accurately report the required information.
- A declaration that the Project Owner's entity-owned emissions are less than 10,000 metric tons CO_2e per year.
- A declaration indicating that Project emissions are no greater in the Project as in the baseline.

- A declaration that the Project is not required by law or other legally-binding, enforceable agreement.
- A declaration that stocking rates on Rangeland owned and controlled outside the eligible LRRs have not increased as a result of the enrollment of the Project.
- A commitment to provide annual compliance self reporting to the Aggregator in the format determined by the Aggregator.

Aggregators must provide a copy of the contract including, at a minimum, the above conditions to the CCX-Approved Verifier.

5.4 Project Start Date and Term

CCX has sought to avoid creating a perverse incentive for reversals in carbon storage and as such does not limit an applicant's eligibility through the use of a start date for the initiation of sustainable Rangeland practices. Since, continuous sustainable Rangeland management is a yearly management decision which can be easily reversed and the discontinuation of the practices can result in reversals of carbon stored in soils. Owners may apply for Rangeland Management Exchange Soil Offsets regardless of the implementation date of the Project.

Projects are eligible for enrollment with a five year forward commitment. In any given year, Projects must be enrolled and submitted for verification prior to September 1 for the Project Owner to receive Offsets for the previous grazing year provided all of the requirements of this Protocol are met.

5.5 Project Location

Eligible geographic areas are defined by CCX using the United States Department of Agriculture (USDA) Land Resource Regions (LRRs). In general these LRRs exhibit long-term annual average precipitation that is not less than 13" and not greater than 40". Rangeland soil carbon management Projects shall be located within eligible counties as indicated in Appendix B. The Verifier shall confirm the Projects inclusion in the eligible county from the list provided in Appendix B. Where a ranch is located within an LRR that is eligible but the county is not listed in Appendix B, the Project may enroll provided the enrolled land can be demonstrated to the Verifier to be within the LRR.

With the exception of US States that are enrolled as CCX Members, federal and state lands are not eligible for enrollment. Tribal lands may be eligible depending on the emission profile and CCX membership status of the tribe. Membership requirements are outlined in the General Provisions document.

5.6 Eligible Rangeland and Management Practices

The Project shall take place on Rangeland as defined by the Natural Resource Conservation Service (NRCS) as:

"Land on which the historic plant community is principally native grasses, grass like plants, forbs or shrubs suitable for grazing and browsing. In most cases, Rangeland supports native vegetation that is extensively managed through the control of livestock rather than by agronomic practices, such as fertilization, mowing, or irrigation. Rangeland also includes areas that have been seeded to introduced species (e.g., crested wheatgrass) but are managed with the same methods as native Rangeland."

In most cases, Rangeland refers to lands in the western part of the U.S., while the more general term "Grazing Lands" is used in regions east of the Mississippi River. The use of the term Rangeland in this Protocol is a land use designation and not a geographic designation. Land that fits the above NCRS definition of Rangeland *may* be eligible for CCX Rangeland Soil Offsets whether it is nominally referred to as Rangeland or Grazing Land provided that appropriate crediting rates can be established by CCX.

5.6.1 Formal Grazing Plan

To be eligible to undertake a sustainable Rangeland management Project, a Project Owner must have, adopt and demonstrate conformance with a written formal grazing plan which, at a minimum, includes the following elements for each management unit (e.g, pasture) within the ranch.

- Forage-animal balance, ensuring forage produced meets demand of livestock and/or wildlife (e.g. stocking rates designated). Planned utilization should not exceed 50% of current year's growth measured near the end of the grazing season.
- Prescribed grazing schedule, addressing periods of grazing, distribution within a pasture and ranch, and management units sensitive to overgrazing or erosion.
- Contingency plan for management under drought conditions. Rangelands enrolled shall have drought management as a part of their formal grazing plan, inclusive of management responses.

5.6.2 Removal of Brush

Brush removal via chemical or mechanical techniques on eligible Rangeland is allowed provided the total acreage treated is less than 10% of the total acreage enrolled. Within the treated area, soil disturbance must be less than 50% and not accelerate erosion. Determination of percent disturbance is based on 50% bare ground determined by visual observation. If brush removal results in soil disturbance (bare ground) greater than 50%, then the acres would be determined to be non-compliant.

Brush encroachment should be addressed in the formal grazing plan. Further, since brush encroachment decreases carrying capacity on Rangeland Project Owners should adjust stocking rate correspondingly.

5.6.3 Eligibility of Rangeland Planted in Trees

Planted treed areas are eligible so long as the understory vegetation supports grazing. Where the understory does not support vegetation for grazing or they are fenced off, these areas should not be included in the enrollment.

5.6.4 Haying

Haying is allowed provided that the primary purpose of the land is for grazing. Land that is hayed more than once every 3 years is considered to be hayland and not eligible.

5.6.5 Additional Inputs

Fertilized and irrigated land is more indicative of cropping systems than native Rangeland systems and does not meet the CCX adopted definition of Rangeland. As such fertilized and irrigated lands are not eligible. Nonetheless, irrigated and fertilized pastures are often used by ranchers as a drought risk management strategy but the irrigated acres may not be included in the Project.

5.6.6 Non-Native Species

Non-native species contribute about the same amount of carbon to the soil as native species so long as the soil is not disturbed. Net primary productivity is determined foremost by rainfall and nutrient availability, as opposed to specie type. The presence of non-native species is not a determinant of eligibility. However, management of noxious and invasive species should be addressed in the grazing management plan if they are a management problem.

5.7 Performance Standard

Soil carbon Projects shall not generate Offsets if the practices are business as usual or not voluntarily undertaken. CCX has identified two tests that Projects must pass to be considered for Offset issuance.

5.7.1 Regulatory Test

In order to be eligible to receive Offsets under these Protocols, the Project shall not be required to perform the elements of this Protocol under any federal, state or local regulations or other legally binding or enforceable agreement (e.g. government permit).

In some cases grazing is performed under a permit which requires practices (e.g. stocking rates and turn in/out dates) which are an incomplete subset of what is required under this Protocol. These elements however are not sufficient to ensure soil carbon increase and therefore they do not eliminate eligibility unless all of the elements included in 5.8.1 are required. An attestation that the Project is not required by law or other legally-binding, enforceable agreement shall satisfy this requirement.

5.7.2 Common Practice Test

Periodic surveys conducted by USDA consistently indicate that there is opportunity to make distinct categorical Rangeland condition improvements on approximately 90% of the privately managed acres.[2] Similarly, other studies demonstrate consistent soil erosion problems and depleted productivity on Rangeland.[3] Given that this Protocol requires best-in-class Rangeland management practices that result in range health improvements by USDA standards, that very few acres (i.e. less than 10% of Rangeland) have no opportunity for categorical health improvement, and that long term sustainable Rangeland management improves Rangeland health, CCX has determined that long term sustainable management practices are not common practice.

6. PROJECT BOUNDARY

A clearly defined boundary is vital to accurately assessing emissions reductions due to the implementation of sustainable Rangeland soil carbon management practices. The boundary

[2] Mitchell, J.E. 2000, United States Department of Agriculture – Forest Service, *Rangeland Resources Trends in the United States*, available at: http://www.fs.fed.us/rm/pubs/rmrs_gtr68.pdf

[3] Chaney, E., Elmore, W., and Platts, W.S., 1990 *Livestock Grazing on Western Riparian Areas, Environmental Protection Agency,* Region 8, Denver, Colorado pp. 45

for the Projects is the Rangeland on which the sequestration activity is taking place. The Aggregator must assess and the Verifier must confirm the geographical boundary of enrolled acres to within 3%. The 3% error is to allow for measurement or mapping imprecision through GIS or other means by the Project Owner, the Aggregator, and the CCX-Approved Verifier. Should the claimed amount of acres match measured acres within 3%, the claimed amount will be used and any subsequent reductions (for roads, ponds, non compliance, etc.) shall be taken from this amount.

6.1 Identification of GHG Sources, Sinks and Reservoirs

ISO 14064-2 requires that the project's GHG Sources and Sinks be categorized as controlled by the Project Proponent, related to the project, or affected by the project. These are discussed below.

6.1.1 Controlled GHG Sources and Sinks

Controlled GHG Sources and Sinks for Rangeland Projects are those that occur on-site and are a direct result of the Project. Therefore, Controlled GHG Sources for Rangeland Projects refer to those that are part of the change in management practices. No Sinks are anticipated in Rangeland Projects.

6.1.2 Related GHG Sources and Sinks

Related GHG Sources for Rangeland Projects refer to those that have material or energy flows into or out of the project. No Related GHG Sources or Sinks are anticipated for Rangeland Projects.

6.1.3 Affected GHG Sources and Sinks

Affected GHG Sources and Sinks are those that are influenced by the Rangeland Projects and result in new or changed activities outside the Project Boundary that actually increase GHG emissions. This concept is commonly referred to as leakage.

To address leakage, eligible Project Owners enrolling a Project must enroll all of their owned or controlled Rangelands that are in LRRs eligible under this Protocol. While CCX does not expect Projects using this Protocol to result in new or changed activities that increase GHG emissions outside of the Project Boundary, Project Owners must attest that:

1. All of their owned or controlled Rangeland in an eligible LRR is enrolled in the CCX, and,

2. Stocking rates on Rangeland owned and controlled outside the eligible LRRs have not increased as a result of the enrollment of the Project.

6.1 Determining the Baseline Scenario

In accordance with the process outlined in ISO 14064, Part 2, possible baseline scenarios were evaluated for sustainable Rangeland management soil carbon Projects. Two baselines were identified by CCX for these Projects:

1. Business as usual Rangeland management practices are current practices that continue on the Rangeland either resulting in a loss of soil carbon or no net gain in soil carbon.
2. Sustainable Rangeland management practices are implemented without the benefit of carbon Offset revenue.

Due to the common practice analysis outlined in Section 5, the most plausible baseline scenario is the continuation of Rangeland either resulting in the loss of soil carbon or no net gain in soil carbon.

6.2 Project Emissions

For Projects, Project emissions are the same in the baseline as in the Project scenario and thus need not be quantified separately. However, Project Owners must attest that reasonably believe that emissions are not greater in the Project scenario as in the baseline.

Where a Project Owner reasonably believes Project emissions are greater in the Project than in the baseline scenario, they shall be calculated by applying fossil fuel emissions factors that are available at http://www.theccx.com/docs/misc/GHG_Emission_Factors.pdf. In these instances, Project emissions shall include emissions from the use of electricity from the electric grid and, the combustion of fossil fuel.

7. Monitoring Requirements

Each project shall have and follow a documented monitoring plan. The Aggregator or Owner shall maintain procedures for obtaining, recording, compiling and analyzing data and information required for quantifying and reporting GHG emissions reductions. At a minimum, the following items must be included in the monitoring plan:

1. contract number

2. contract name (if applicable)
3. Project Owner name,
4. Project Owner contact person name
5. farm/ranch name,
6. county,
7. state,
8. zip code,
9. Project Owner contact phone number
10. Project Owner contact email
11. start year of contract,
12. gross farm/ranch acreage,
13. enrolled acres
14. crediting rate,
15. Offsets claimed for the farm/ranch by vintage,
16. Offsets issued for the farm/ranch by vintage,
17. Project type (conservation tillage, grassland, rangeland, etc.),
18. Offsets claimed for the project for the contract years(s) by vintage
19. indication of whether the project was field verified in any year
20. indication of the compliance status of the contract (either, compliant, non-compliant or corrected),
21. indication of adjustments made (to be made) in the Soil Carbon Reserve Pool for historic years based on current year discovery of error or non-compliance,
22. annual self reporting compliance statement,
23. loss/acquisition of land,
24. changes to formal grazing plan,
25. changes in voluntary execution of project,

26. forage animal balance,
27. grazing schedule,
28. stocking rates by management unit and adjustments,
29. planned and actual turn in/ turn out dates,
30. variations in grazing schedule,
31. grazing distribution plan,
32. recording of drought triggers,
33. execution of documentation of drought contingency plan,
34. removal of brush and % disturbance,
35. 12 month Standardized Precipitation Index (SPI) from November to October, and
36. other elements to ensure conformance with this protocol.

8. QUANTIFYING GHG EMISSION REDUCTIONS

Emission reductions shall be calculated by multiplying qualifying acres by the crediting rate less Project emissions (if any).

8.1 Soil Carbon Sequestration Estimates and Offset Issuance Rate

To develop the Protocol, CCX convened a group of Rangeland experts to review the published literature, management practices and soil carbon sequestration rates. Based on their technical review, *inter alia*, the technical experts provided CCX with a range of additional soil carbon sequestration that result from the specified Rangeland management practices. The range of soil carbon sequestration rates represents a best estimate based on a detailed assessment of peer-reviewed scientific literature, actual soil sampling at NRCS plots, Flux tower data and runs of the Century model using COMET VR. A summary of the technical committee's review of soil carbon sequestration is contained in Appendix C of this Protocol.

Recognizing that actual soil carbon sequestration on Rangeland is continuously changing depending on a variety of conditions; CCX established Offset issuance rates as a conservative approximation of average soil carbon uptake under specific management practices, regions and climate conditions. The Offset issuance rates are conservative as they are discounted from the mean of the range of soil carbon sequestration values.

Rangeland Soil Carbon Management Offset Issuance rates are as follows (in metric tons CO_2/acre/year):

LRR Region	Offset Issuance Rate
Northwestern Wheat and Range Region (LRR B)	0.12
California Subtropical Fruit, Truck, and Specialty Crop Region[4] (LRR C)	0.16
Rocky Mountain Range and Forest Region (LRR E)	0.12
Northern Great Plains Spring Wheat Region (LRR F)	0.12
Western Great Plains Range and Irrigated Region (LRR G)	0.27
Central Great Plains Winter Wheat and Range Region (LRR H)	0.20
Southwest Plateaus and Plains Range and Cotton Region (LRR I)	0.13
Southwestern Prairies Region (LRR J)	0.32

8.2 Participation and Management under Drought Conditions

Average soil carbon sequestration rates used to inform the Offset issuance rate shown above are based on a variety of sources and include variability related to short term drought. As such, individual year drought is reflected within the carbon sequestration rates used to determine the Offset issuance rates above. Nonetheless, to remain in compliance, participating ranches must implement their drought management plans based on short term conditions.

Because of the overriding influence of long-term drought and its impact on sustainable plant growth and likely effect on multi-year carbon uptake, the following rules shall be applied to Projects experiencing long-term drought during the Project period. Long-term drought is defined as occurring when soil water deficits limit vegetation production below a long-term average for a sustained period of time. For the purposes of the CCX Rangeland Protocol, long-term drought status will be determined by county

using the 12 month Standardized Precipitation Index (SPI) from November to October with the following on-line tool: http://drought.unl.edu/monitor/spi-dailygridded.html. A Project shall be considered to be in long-term drought if it experiences two or more consecutive years in which the 12-month SPI from November to October is -1 or lower.

At the end of the five year contract period, the Aggregator or Project Owner shall determine whether any Projects they have enrolled experienced a long-term drought during the crediting period. If so, any Offsets issued to qualifying land affected by long-term drought shall be deducted from the Soil Carbon Reserve Pool (by vintage) associated with the aggregated pool or individual Project. The maximum cancellation from the reserve pool due to drought is the total holdings of the Soil Carbon Reserve Pool. This requirement shall be reviewed by the Verifier at the completion of the 5th year of enrollment.

[4] In this region, a key feature of the landscape is the Oak tree layer interspersed within Rangelands. Research has shown that the native Oak trees have a positive impact on nutrient cycling, productivity and carbon storage in the soil system. Projects must have left the tree layer intact in order to qualify for Offsets.

Given the risk of retroactive cancellation, it is left to the Aggregator's discretion whether to include for issuance acres or ranches that have just experienced a season of drought. Further, the aggregator may elect not to sell tons issued to Projects that are in the first year of a potential long term drought.

9. Project Permanence

To address uncertainty in the permanence of carbon sequestration in Rangeland Projects, Project Proponents shall be required to:

1. Hold Offsets as escrow in a Soil Carbon Reserve Pool.
2. Include in the contract from each Pooled Participant a five-year commitment to maintain the project.

9.1 Soil Carbon Reserve Pool

As a precaution against reversals in carbon sequestration on Rangeland, each CCX Rangeland Soil Project shall be required to place 20% of the Offsets it earns into a Soil Carbon Reserve Pool. These Offsets shall remain the property of the Project Owner(s) and all Offsets that remain in the Soil Carbon Reserve Pool shall be released to Project Owners upon satisfaction of the five year commitment. In the event that a Project Owner does not conform to the requirements of this Protocol, such event shall be promptly reported to CCX (such reporting shall occur through a Project's Aggregator if the Project is registered through a CCX Offset Aggregator). CCX will then cancel Offsets held in the Soil Carbon Reserve Pool in an amount and vintage equal to the quantity of Offsets previously issued to the Project.

In the case of non-compliance with the terms and conditions of the Protocol, CCX shall cancel from the Soil Carbon Reserve Pool a quantity of Offsets equal to the total quantity of Offsets issued to the non-compliant Project. The Owner of the non-compliant Project may be prohibited from further participation in CCX.

10. Reporting and Record-keeping Requirements

The Project developer shall implement monitoring, recordkeeping and procedures for quality management and uncertainty assessments. All relevant Project documentation shall be kept by the Aggregator or Project Owner for a minimum of 2 years beyond the completion of the Project.

11. VALIDATION AND VERIFICATION REQUIREMENTS

11.1 Validation

CCX Projects utilizing these guidelines are validated one of two ways. Projects that adhere strictly to the requirements of this protocol are validated by CCX staff and do not require a separate Validation by CCX Offsets Committee. For all Projects seeking to deviate from specific components of this protocol, the Project Proponent is required to complete the deviation request section of the CCX Project Implementation Document (PID) for review and approval by the CCX Offsets Committee. Upon receipt and review of the CCX PID, the CCX Offsets Committee will review the feasibility and appropriateness of the requested deviation(s) and, as needed, seek guidance from appropriate technical experts. Project Proponents will be notified of the CCX Offsets Committee decision and shall proceed accordingly.

11.2 Verification

Prior to undertaking verification, the prospective Verifier must conduct a Project specific conflict of interest process. The prospective Verifier must complete and submit the CCX Project Specific Conflict of Interest Form[5] to CCX for approval prior to the commencement of verification activities.

Projects seeking to register Offsets shall be verified by a CCX-Approved Verifier in accordance with CCX General Offsets Program Provisions, CCX Verification Guidance Document and the Project Protocols. A checklist list of verification requirements is contained in Appendix A. Independent verification is critical to ensure that the requirements of this Protocol are correctly applied. Projects shall be verified on an annual basis at minimum.

To ensure impartiality, completeness and consistency in the verification report review process an additional independent review of the submitted verification reports is conducted by the CCX Provider of Regulatory Services. Further information about the roles and responsibilities of Verifiers and Members during verification are discussed in detail in *Chicago Climate Offset Program Verification Guidance Document*.

11.2.1 Verification Frequency

Verification must occur each year of the Project. Verification shall consist of a desk review of all of the enrolled ranches and a field verification of a sample of enrolled ranches. For

[5] CCX Project Specific Conflict of Interest Form can be found in the Associated Documents section of the CCX website: www.theccx.com.

individually enrolled ranches or for pooled Projects where field visits occurred at all of the enrolled ranches, the field component of verification must occur in the first year, third year and fifth year of the Project.

Where verification is performed in a year beyond the first, the Verifier shall confirm ranch level compliance based on the requirements of this Protocol for the year of verification. Based on field observations, should the Verifier suspect non-compliance in previous years of a ranch's enrollment in CCX, the Verifier has the right to request records for previous enrollment years to confirm compliance.

11.2.2 Desk Verification

All contracts will be subject to desk verification during the first year verification period to determine that an adequate Rangeland management plan exists and that adequate ranch records are being kept to document compliance with the key elements of the Protocol. First year desk verification will review all of the enrollments to ensure inclusion of the elements outlined in Appendix B with the exception of those that relate only to field level confirmation.

For individually enrolled ranches or for pooled Projects where all ranches were field verified in year 1 and where the Project Proponent has elected not to undertake field verification in years 2 and 4, a desk verification of those ranch records shall occur in years 2 and 4. This verification shall confirm that ranch records demonstrate conformance with this Protocol.

11.2.3 Sampling for Field Verification

Each farm/ranch must be included in the Aggregators Enrollment Summary submitted to the Verifier. The Aggregator Enrollment Summary Form must include, at a minimum, items 1-17 listed in section 7.

The Verifier shall draw a sample of ranches from the Aggregator Enrollment Summary for in-field verification. Once the sample has been drawn, the Verifier shall document the selected ranches and provide a list to the Aggregator and CCX. Following this, the Aggregator shall supply the Verifier with all the required documentation to demonstrate ranch level conformance to the Protocol.

During the initial year of enrollment each ranch of 30,000 acres or more must be subjected to in-field verification and be included in the Verifier's report. A random sample of ten percent of the remaining ranches must also be subjected to in-filed verification inspection.

Once the first year verification has been completed, subsequent verifications require a ten percent sampling of total enrolled acreage (both large and small ranches) to confirm compliance. In order to avoid the verification of a single ranch encompassing ten percent of entire pool acreage amount, the ten percent sampling of acreage must be drawn from at least ten percent of the total number of ranches/contracts enrolled in the pool.

The Verifier may add enrollees to the selection of those to be included for field verification (i.e. in addition to the randomly selected 10%) where there is a suspicion of non-compliance.

11.2.4 In-field Verification Requirements

For field verified ranches, the Verifier must confirm all of the items outlined in Appendix B of the Protocol and as provided by the guidance provided in section 12 of this Protocol.

Basic Rangeland health indicators will be used to verify sustainable Rangeland practices. The on-site visits must confirm vegetative condition (i.e. net primary productivity and utilization), cover and percentage of bare ground, and species composition, all in comparison to the applicable USDA Ecological Site Description.

Further the Verifier shall document range condition, by digital photographs, close-up of grass cover conditions. The Verifier should use good judgment in how many photos are necessary for management units/pastures which are similar.

11.2.5 Non-Compliance and Enrolled Acreage Adjustment

All instances of non-compliance, whether found by the verifier or self-reported by the project owner, shall be recorded with appropriate adjustments made in the Aggregators database. Adjustments may result in cancellation of previously issued Offsets (taken from the Soil Carbon Reserve Pool) in instances where the project received Offsets in previous years.

Enrolled acreage claimed by the Project Proponent and must be within 3% of the Verifiers measurement. Where these match within 3%, the claimed acreage shall be the enrolled amount except where differences arise from obvious clerical errors. Following this initial calculation of enrolled acreage, total error/non-compliance shall be determined for the field verified ranches and all known errors or non-compliance recorded and corrected at the Project level.

Verifier shall aggregate all the project-level errors and/or non compliant acres for the field verified ranches and determine an overall sample error/non-compliance rate. If the error/non-compliance rate for the sample is greater than 3%, the Offset issuance to ranches not subjected to field verification shall be reduced from the claimed amount by the determined error/non-compliance rate.

Deliberate non-compliance may result in disqualification of the entire ranch(es).

11.2.6 Submission for Issuance

Each pool submitted to CCX for issuance shall be checked for accuracy by the Verifier to ensure that the results of the desk and in-field verification have been properly adjusted in the Aggregators database and issuance request. Following sampling and field verification, the results of verification must be provided to the aggregator and appropriate adjustments must be made in the Aggregators database. Subsequent to adjustments being made by the Aggregator, the database must be sent back to the Verifier ad entitled "Adjusted Aggregator Enrollment Summary Form". The Verifier shall confirm the required adjustments were made send the verification report and Adjusted Aggregator Enrollment Summary Form to CCX. The adjusted Aggregator Enrollment Summary Form must be sent in Microsoft Excel format and include, at a minimum, items 1-21 listed in Section 7.

12. VERIFICATION GUIDANCE AND PROCEDURES

In addition to the previous sections of this Protocol, this section will serve as a guide to identify items that should be reviewed and assessed in order to successfully complete a third party verification for CCX Rangeland Soil Carbon Management Offset Projects. The development of the process defined herein was guided by the requirements of the ISO 14064-3: Specification with guidance for the validation and verification of greenhouse gas assertions.

12.1 Fundamentals

The objective of verification is to confirm that the Project conforms to the requirements of the CCX Rangeland Soil Carbon Management Protocol, the standard of verification, and that the associated emission reductions from carbon sequestration are complete and accurate. The Verifier must confirm the following verification characteristics at the beginning of the verification process:

a. The Project's consistency with the pre-defined boundary and baseline scenario as stated in the Protocol.

b. The physical infrastructure, activities, technologies and processes of the Rangeland carbon Offset Project.

c. The GHG sources, sinks, and reservoirs (relevant GHG sources, sinks and reservoirs included within the pre-defined Project Boundary are identified in section 6.1 of this Protocol).

d. The types of GHGs (the GHGs to be included are identified in section 6 of this Protocol);

e. The time period(s) for the GHG assertion; and

f. Verification objectives.

ISO 14064-3 further requires agreement on the level of assurance, criteria, and the materiality threshold to be applied during the course of verification.

To maintain consistency and ensure integrity, CCX has pre-defined the level of assurance, criteria, and the materiality threshold to be applied in Project verifications as follows:

g. A "reasonable" level of assurance shall be achieved for all Project verifications;

h. The criteria against which the Project shall be assessed are the specific requirements of the CCX Rangeland Soil Carbon Management Project Protocol; and

i. The level of materiality shall be set at 3% of the overall agricultural soil Offset at the "pool" and Project level.

12.1.1 Level of Assurance and Materiality

The "level of assurance" and "materiality" concepts mentioned above are interrelated at the pool level. Under the CCX program, a Verifier may only provide a reasonable level of assurance if the identified discrepancies leading to the GHG assertion result, in aggregate, in less than 3% of the total Project GHG emission reductions. Any identified discrepancy (or the aggregation of all discrepancies) that can be expected to exceed the materiality threshold of 3% will be considered a material error and will require corrective action. At the Project level, the Verifier will report all instances of errors or non-conformance, regardless of the percent level of non-conformance after first having determined the enrolled acres as explained in Section 11.2.5. Any non-conformance at the Project level will be reported and necessary adjustments will be made in the Aggregator's database.

All of the above listed verification characteristics, along with an outline of verification activities and the verification schedule, shall be identified and documented in a verification plan.

Lastly, the Verifier shall develop a sampling plan that takes into consideration the verification characteristics, the evidence required to achieve a "reasonable" level of assurance, and the information necessary to assess the risk of errors, omissions and misrepresentations. As required by the CCX Rangeland Soil Carbon Management Project Protocols, all Projects will undergo desk verification in Year 1 of the contract. During the initial year of enrollment each ranch of 30,000 acres or more must be subjected to in-field verification and included in the Verifier's report. A 10% random sample of the remaining ranches less than 30,000 acres will be subjected to on-site inspection.

Once the first year verification has been completed, subsequent verifications require a ten percent sampling of total enrolled acreage (both large and small ranches) to confirm compliance. In order to avoid the verification of a single ranch encompassing 10% of entire pool, the ten percent sampling of acreage must be drawn from at least 10% of the total number of ranches/contracts (the pool).

12.2 Verification of Project Eligibility

Verifiers must assess Project eligibility in accordance with the CCX Rangeland Soil Carbon Management Project Protocols. In order to verify that the Project is compliant with the eligibility criteria outlined in the CCX Rangeland Soil Carbon Management Project Protocols, Verifiers must review the following:

1. Documentation the Project Owner has rights to the GHG mitigation attributes associated with the Project:

    - In general, the Project Owner through ownership, lease or other legally binding agreement has management control of the enrolled land and Offset. For pooled Project the contract between the Aggregator and the Project Owner will include a declaration/attestation of ownership or management control.

    - The Project Owner shall not be required to perform Rangeland soil carbon management or restoration under any federal, state or local regulations or other legally binding or enforceable agreement (e.g. permit).

2. Determine if the Project Owner is a large emitter as described in the CCX Rangeland Soil Carbon Management Project Protocols.

    - Documentation that the Project Owner is not is a large emitter. For pooled Projects, the contract between the Aggregator and the Project Owner will include a declaration/attestation relating to Project Owner direct emissions. For non-pooled Projects an attestation must be provided on this point.

    - If the Project Owner is a large emitter, then they are required to join CCX prior to Project enrollment.

    - Federal land is not eligible for enrollment.

    - State land is not eligible unless the state is a CCX Member.

    - Tribal lands are eligible provided the tribe is not a large emitter or is a CCX Member. Where tribal land is enrolled and the tribe is not a CCX Member, an attestation from the tribe relating to its direct emissions is required to satisfy this Protocol.

3. Rangeland Offset contracts must reflect a five year forward commitment:

    - The Project Owner may receive Offsets for the previous grazing year provided all of the requirements of this Protocol are met. The previous year Offsets are not included in the five year forward contract commitment.

    - For pooled Projects, the contract must include a five year forward term. For Projects that are not aggregated, the CCX commitment letter required by CCX Membership shall satisfy this requirement.

    - Contract termination or non-compliance results in forfeiting all previously earned Offsets as part of the current five year contract.

        - If contract termination or non-compliance is only applicable to a subset of the enrolled acres, then an equivalent amount of Offsets will be cancelled in the reserve pool for the acres terminated or non-compliant.

        - A system needs to be in place at the Aggregator to document non-compliance on subset of enrolled acres for annual consistency.

4. Rangeland Offset Projects are eligible on Rangeland within the designated geographic areas defined in the Protocol.

    - Projects split along county lines will receive the crediting rate for the acres within each eligible county.

    - Where a Project is located in an eligible LRR but the county is not listed in Appendix A of the Protocol, the Project Proponent must demonstrate to the Verifier that the subject ranch is included within the LRR.

5. Rangeland Offset Projects are required to adhere to sustainable grazing practices that constitute best-in class Rangeland management that result in range conditions improvements by USDA standards.

    - A formal grazing plan defined in Section 5 will be the primary document to determine required Rangeland management practices. Field verification and ranch records will corroborate adherence to the formal grazing plan.

For the regulatory criteria of the performance benchmark, Verifiers shall ensure that the Project is not required by any federal, state or local regulation or other legally binding framework (e.g. permit). For purposes of verification, Verifiers must review the contract between the Aggregator and the Project Owner to ensure the required declarations have been made. For Projects that are not aggregated a stand-alone declaration shall satisfy this requirement.

In some cases grazing is performed under a permit which requires practices (e.g. stocking rates and turn in/out dates) which are an incomplete subset of what is required under this Protocol. These elements however are not sufficient to ensure soil carbon increase and therefore they do not eliminate eligibility unless all of the elements included in Section 5.7.1 of the Protocol are required.

12.3 Project Boundary

The assessment of the Rangeland Offset Project Boundary identifies the appropriate GHG sources, sinks, and reservoirs. The Project Boundary is defined as the enrolled acres as determined by the contract and documented by maps, tax records, etc. Verifiers shall measure the ranch boundary and determine that the measured acres minus any excluded acres match within 3% of the contracted acres. The 3% buffer is to allow for measurement errors by the Verifier, Project Owner, and Aggregator and does not include non-eligible acres. Contracts where the enrolled acreage cannot be verified within 3% are determined to be unverifiable and will be returned to the Project Proponent with a corrective action request.

For the desk verification component, where a ranches' acreage has been previously determined by participation in an FSA program or other sources of legal land description including acreage is provided and there are no complexities insofar as enrolled acreage (e.g. intermingled state or federal land, non included land etc.), the Verifier may confirm acreage using these documents.

Verifiers shall review all GHG Sources, Sinks and Reservoirs to verify that the Project Proponent has properly accounted for and reported all of the associated direct and indirect GHG emissions above the baseline and present within the Project Boundary as required in the Protocol. Within a Rangeland Project, GHG Sources above the baseline of normal Rangeland activities are assumed to be negligible. For verification purposes, an attestation by the Project Owner that emissions are not greater in the Project scenario shall satisfy the requirement for verification of Project emissions. For pooled Projects the attestation shall be included in the contract between the Aggregator and the Project Owner. For Projects that are not pooled, a standalone attestation must be provided to the Verifier.

12.4 Formal Grazing Plan

To be eligible to undertake a sustainable Rangeland management Project, a rancher must have, adopt and demonstrate conformance with a formal grazing plan which, at a minimum, includes the elements listed below and meets or exceeds the NRCS standard. A formal grazing plan will document that sustainable grazing practices that follow best-in class Rangeland management are implemented on the ranch.

12.4.1 Forage-Animal Balance

The forage-animal balance ensures the forage produced meets demand of livestock and/or wildlife (e.g. stocking rates designated) on a pasture or management unit basis. Supplemental feed is addressed if demand exceeds timely production.

1. A forage inventory is not required; however, estimates of forage production must be documented based on soil type or ecological site and the forage production values should be documented from a reputable source (i.e. ecological site description, college or university, extension, primary literature).

2. Forage production is required for each management unit. Where multiple soil types or ecological sites are present within a management unit and constitute multiple forage production values, either an average forage production or the forage production based on the majority of acres should be used.

3. Provision for supplemental feed to meet livestock demands is required if demand exceeds production.

12.4.2 Prescribed Grazing Schedule

Prescribed grazing schedule indicates the planned number and duration of livestock within a management unit. Development of the prescribed grazing schedule should consider periods of grazing, distribution within a pasture and ranch, and management units sensitive to overgrazing or erosion.

1. All enrolled acres must be included within a management unit of the prescribed grazing schedule.

2. Each management unit must have a planned stocking rate based on the forage-animal balance (12.4.1) and include the planned dates for periods of grazing (turn in/out) in which livestock will use the management unit. Significant variations in head numbers or dates, as determined by the Verifier, from the planned stocking rate or dates constitute non-conformance. The ranch must document and justify changes to the prescribed grazing schedule based on forage production, climatic factors, changes to ranch operation, or changes to ranch goals and objectives so long as sustainable grazing practices are consistent with best-in class Rangeland management. Planned utilization should not exceed 50% of current year's growth measured near the end of the grazing season.

3. Distribution of livestock utilization is another key element that must be verified within the prescribed grazing schedule, regardless of a grazing system. Implementation of a grazing system does not constitute conformance. Distribution will be assessed on a pasture basis by examining the utilization of key species as identified in the ESD for defined key areas of the pastures. Evidence of practices and

methods to facilitate spatial and temporal distribution of livestock will assist in verifying this requirement. Examples of practices and methods include: patch burning, herding, salt/water/supplemental feed placement, alteration of grazing seasons, etc.

12.4.3 Contingency Plan

The contingency plan is a forward planning document for unpredictable events such as flood, fire, drought, hail, insects, and disease which minimizes potential damages and carbon loss to grazing lands.

1. At a minimum the contingency plan will mitigate drought events and provide adjustments to stocking rate and/or grazing schedule to prevent resource degradation and carbon loss.
2. Drought contingency plans must establish a trigger for implementation of the drought contingency plan. Upon verification if the established trigger has been met the Verifier will document the implementation of the drought contingency plan.
3. Documentation of adherence to the drought contingency plan is required.

12.5 Minimum Rangeland Health Standard

The following Rangeland health indicators as observed during the field verification will be used to assess conformance with required practices.

12.5.1 Utilization

Utilization data are important in evaluating the effects of grazing on Rangeland and can be used as an indicator of grazing pressure and potential overgrazing. Utilization is used to determine if adjustments are needed in grazing management or stocking rate. Utilization measures the percentage of annual herbage production that has been removed. It is generally the percentage of available forage that has been consumed or destroyed. Utilization is expressed in terms of the current year's production removed.

A qualitative assessment of utilization known as the Landscape Appearance Method[6] will be used for verification purposes. This technique uses an ocular estimate of forage utilization

[6] U.S. Department of Agriculture and U.S. Department of the Interior, 1999, Utilization Studies and Residual Measurements – Interagency Technical Reference. Available at http://www.blm.gov/nstc/library/pdf/utilstudies.pdf

based on the general appearance of the Rangeland. Utilization levels are determined by comparing observations with written descriptions of each utilization class. Utilization over 60% which has the appearance of complete search with herbaceous species almost completely utilized and less than 10% of the current seedstalks remaining is the critical threshold of utilization for this program. Utilization over the 60% threshold level at the pasture and ranch level will be considered non-conformant. This utilization conformance criteria is similar to the general sustainable grazing principle of "take half and leave half" of the forage produced during the grazing season.

12.5.2 Erosion

Rangeland Offsets are issued on the basis of soil carbon sequestration and as such management units with significant erosion are ineligible or non compliant. For the purpose of verification, significant erosion is defined as having the Soil Surface Loss or Degradation indicator from Interpreting Indicators of Rangeland Health – Technical Reference 1734-6, Version 4 at or beyond the *Moderate to Extreme* category.

12.5.3 Bare Ground

Rangeland Offsets are issued on the basis of soil carbon sequestration and as such management units with bare ground exceeding what is expected in the ESD are ineligible or non compliant. For the purpose of verification, significant bare ground is defined as having the Bare Ground indicator from Interpreting Indicators of Rangeland Health – Technical Reference 1734-6, Version 4 at or beyond the *Moderate to Extreme* category.

12.5.4 Invasive Species

Invasive species are indicative of a transitional state in which active management or conservation practices are required to cross the threshold to a more stable transitional state. Rangeland sites determined at or beyond the *Moderate to Extreme* category according to Interpreting Indicators of Rangeland Health – Technical Reference 1734-6, Version 4 in which invasive species are common or dominate a management unit are determined to be ineligible or non compliant. If active management or conservation practices for invasive species are documented in the formal grazing plan and the Verifier can confirm adoption of active management or conservation practices, then the management unit is conformant.

12.5.5 Grazed Land

Rangeland must have a prescribed grazing schedule and have adequate forage production for Project conformance. Management units where grazing does not occur at least every other year are ineligible for Rangeland carbon Offsets. Additionally, management units or areas within a management unit where forage production is inadequate due to badlands, rock outcropping, poor soils (e.g., saline/sodic conditions), and steep terrain, are ineligible. Other areas of a ranch that would fall into un-grazeable lands include roads, lots, buildings, and ponds.

Land which does not qualify as grazed land should not be enrolled as discussed above. These acres must be confirmed by the Verifier for all ranches which are field visited. At the option of the Aggregator, the non-enrollment rate, in percentage terms, determined for the field verified portion of the pool may be applied to the ranches that were not field verified for the year. Alternatively, the Aggregator may determine actual or assumed non-enrollments but each would need to be confirmed by the Verifier during desk verification.

Where actual non-enrollment acreage has been determined by the Aggregator and confirmed by the Verifier, it shall not be adjusted upwards during the enrollment period.

12.6 Special Considerations

12.6.1 Removal of Brush

Brush removal via chemical or mechanical techniques on eligible Rangeland is allowed provided the total acreage treated is less than 10% of the total acreage enrolled. If brush removal involves drastic soil disturbance (>50% soil surface disturbance), such as from raking, the acres will be deemed non-conformant.

12.6.2 Eligibility of Rangeland Planted to Trees

Treed areas are eligible so long as the understory vegetation supports grazing. Where the understory does not support vegetation required for grazing, these areas are not eligible.

12.6.3 Fertilizing, Irrigation and Haying

Fertilized and irrigated land is more indicative of cropping systems than Rangeland systems and does not meet the NRCS definition of Rangeland. As such fertilized and irrigated lands are not eligible. Haying is allowed provided that the primary purpose of the land is for grazing. The use is considered to be primary where it is more frequently than every three years. Land that is considered cropland or hayland is not eligible for the Sustainably Managed Rangeland Offset and will be considered non-conformant in the verification process.

12.6.4 Temporary Deferment

Practices such as deferment do not make land ineligible provided they are appropriate for the site and included in the formal grazing plan. To maintain eligibility, land that is temporarily deferred may be so no more frequently than every-other-year.

12.6.5 Non-Native Annual Grasses or Species

Although non-native species do not necessarily reduce the potential for increased carbon sequestration in Rangelands, non-natives can pose a threat to sustainable Rangeland management. Grazing plans should account for the management necessary to reduce the impact of invasive species. An exception is in the Mediterranean annual grasslands in LRR C where non-native annual grasses are generally accepted as naturalized. Planning for increased carbon sequestration should allow for dominance by annual grasses in these ecosystems, but still meet the criteria for grazing management.

12.7 Field Observation Techniques

Field verification is ideally done after turnout in the spring and during the growing season when plants are actively growing. Verification can be done during the fall and winter months if livestock are actively grazing but it may be much more difficult to assess some of the measurements needed, depending on area of the country and climate. Verifiers need to survey each management unit (i.e. grazing pasture or area), or each “zone” based on vegetation, topography or precipitation. Location of sample sites should be documented for future comparison. The use of ecological site descriptions is recommended, rather than the Verifier developing their own vegetation sampling scheme.

The sample site boundaries include the management unit (pasture) or ecological site. One sample site is conducted for every 5,000 acres or for every major ecological site, whichever is less. Additional sample sites may be conducted for pastures or management units with varying management practices or stocking rates. At each sample site, the Verifier shall (1) complete a site verification form that documents the critical Rangeland health indicators as described above including utilization and the presence of the dominant plant species and invasive or noxious species and (2) collect a close-up and landscape photograph showing vegetative conditions (land cover). Any non-conformant range conditions must be documented with photographs.

12.8 Evaluation of GHG Assertion

In the evaluation of the GHG assertion, the Verifier shall assess whether the Project has:

1. Adequately met eligibility requirements and criteria as stated in the Sustainable Rangeland Management Carbon Offset Project Protocols;

2. Determine whether the emission reductions and all other Project characteristics are supported by complete, accurate, and transparent data and information; and

3. Conclude whether the GHG assertion is free from material misstatement.

12.9 Verification Report

The CCX-Approved Verifier shall submit a verification report in accordance with CCX procedures provided in the CCX Verifier Guidance document.

APPENDIX A – VERIFICATION CHECKLIST

CCX Requirement	Assessment Criteria	Verification Findings
Validation	CCX Project Approval Letter.	
Verification: Conflicts of Interest	Complete a conflicts of interest assessment.	
Contract Information	Verifier must obtain and review contract information.	
CCX Membership	Confirm the Project Owner is a CCX Member or enrolled with a CCX Aggregator.	
	Confirm through existence of the Project Owner Attestation that the Project has not been double counted.	
Eligibility Governing Entities with Minor Emissions	Confirm requirement for Project Owner direct emissions.	
Ownership and Control	Confirm the enrollee has management control of the enrolled land and the GHG mitigation rights associated with the Project.	
Land acquisition and disposition and leases	Confirm removal/inclusion of land in aggregation database.	
	Confirm proper transfer of GHG rights (if applicable).	
Project Definition	Confirm the existence of a formal grazing plan document which addresses: forage animal balance, livestock distribution and a contingency plan for management	

	under drought.	
	Confirm a five year forward commitment from the date of enrollment.	
Required Contract Conditions for Aggregated Projects	Confirm contract requirements in aggregation contract.	
Project Start Date and Term	Confirm five year forward commitment.	
	Confirm historic verification cutoff date met (e.g. September 1).	
Project Location	Confirm Projects are within eligible counties and/or LRR.	
Eligible Rangeland	Confirm Projects are being undertaken on eligible Rangeland.	
Regulatory Test	Confirm Project is not required by federal, state or other enforceable agreement (e.g. government permit).	
Formal Grazing Plan	Confirm forage animal balance meets demand of livestock.	
	Documented prescribed grazing schedule.	
	Document with planned stocking rates by management unit.	
	Planned and actual turn in/turn out dates by management unit.	

	Documented variations in the prescribed grazing schedule and justifications.	
	Documented distribution plan (time and space).	
	Documented drought contingency plan.	
	Plan to adjust stocking rates in drought.	
	Identification of a trigger for implementation of drought contingency plan.	
	Monitoring of adherence to drought contingency plan.	
Removal of Brush	Confirm less than 50% disturbance.	
Project Boundary	Confirm boundaries of enrolled land.	
Project Emissions	Confirm through existence of the Project Owner Attestation that the Project does not have a source of emissions.	
Leakage	Confirm enrollment of all eligible land by the Project Owner.	
Quantification of GHG Emission Reductions	Confirm Offset issuance rates by acres and county/LRR are accurate.	
Participation and Management under	Confirm tracking of drought classification.	

Drought Conditions	At the completion of the 5 year contract confirm the creation of a drought summary report for submission to CCX documenting the vintage and number of tons to be cancelled for drought.	
Desk verification	Confirm pool or Project ability to undergo desk verification only.	
Sampling for Field Verification	Confirm Aggregator Enrollment Summary has elements a-j and was sent to CCX.	
	Confirm random sample.	
In-field verification Requirements	Determination of utilization.	
	Determination of erosion.	
	Determination of bare ground.	
	Determination of treatment of invasive species.	
Non-Compliance and Enrolled Acreage Adjustment	Confirm removal of documented ineligible or non-compliant acres.	
Non Compliance Rate	Confirm that all verification results have been updated in the Aggregator database and that error greater than 3% have been applied to the un-sampled participants.	
Submission for Issuance	Complete a Verification Statement in respect of the Project Proponents GHG Assertion.	

APPENDIX B - COUNTIES THAT QUALIFY FOR SUSTAINABLE RANGELAND MANAGEMENT SOIL CARBON OFFSETS BY LAND RESOURCE REGION (LRR)

Land Resource Region (LRR) – B	IDAHO	OREGON	WASHINGTON
	Ada	Baker	Adams
	Bannock	Crook	Asotin
	Bear Lake	Deschutes	Benton
	Bingham	Gilliam	Chelan
	Blaine	Jefferson	Columbia
	Bonneville	Morrow	Douglas
	Butte	Sherman	Franklin
	Camas	Umatilla	Garfield
	Canyon	Wasco	Grant
	Caribou	Wheeler	Kittitas
	Cassia		Klickitat
	Clark		Lincoln
	Elmore		Okanogan
	Fremont		Spokane
	Gem		Walla Walla
	Gooding		Whitman
	Jefferson		Yakima
	Jerome		
	Latah		
	Lemhi		
	Lewis		
	Lincoln		
	Madison		
	Minidoka		
	Nez Perce		
	Payette		
	Power		
	Teton		
	Washington		

Land Resource Region (LRR) – C	CALIFORNIA		
	Alameda	Marin	Santa Clara
	Butte	Merced	Santa Cruz
	Calaveras	Monterey	Solano
	Colusa	Napa	Sonoma
	Contra Costa	Orange	Stanislaus
	Fresno	Sacramento	Sutter
	Glenn	San Benito	Tehama
	Kern	San Diego	Ventura
	Kings	San Joaquin	Yolo
	Lake	San Luis Obispo	Yuba
	Los Angeles	San Mateo	
	Madera	Santa Barbara	

Land Resource Region (LRR) – E	COLORADO	IDAHO	MONTANA
	Alamosa	Adams	Beaverhead
	Archuleta	Benewah	Broadwater
	Boulder	Boise	Carbon
	Broomfield	Bonner	Cascade
	Chaffee	Boundary	Deer Lodge
	Clear Creek	Clearwater	Flathead
	Conejos	Custer	Gallatin
	Costilla	Idaho	Glacier
	Custer	Kootenai	Granite
	Douglas	Shoshone	Jefferson
	Eagle	Valley	Judith Basin
	El Paso		Lake
	Fremont		Lewis and Clark
	Garfield		Lincoln
	Gilpin		Madison
	Grand		Meagher
	Gunnison		Mineral
	Hinsdale		Missoula
	Huerfano		Park
	Jackson		Powell
	Jefferson		Ravalli
	Lake		Sanders
	Larimer		Silver Bow
	Mineral		Stillwater
	Ouray		Sweet Grass
	Park		Teton
	Pitkin		
	Rio Grande		
	Routt		
	Saguache		
	San Juan		
	Summit		
	Teller		

Land Resource Region (LRR) – E	NEW MEXICO	OREGON	UTAH
	Colfax Rio Arriba Taos	Grant Union Wallowa	Cache Carbon Daggett Duchesne Morgan Rich Summit Utah Wasatch

Land Resource Region (LRR) – E	WASHINGTON	WYOMING
	Ferry Pend Oreille Stevens	Big Horn Hot Springs Lincoln Park Sublette Teton Uinta

	MONTANA	NORTH DAKOTA		SOUTH DAKOTA
Land Resource Region (LRR) – F	Blaine	Adams	Ramsey	Aurora
	Chouteau	Barnes	Ransom	Beadle
	Daniels	Benson	Renville	Brown
	Hill	Bottineau	Richland	Brule
	Liberty	Burke	Rolette	Buffalo
	McCone	Burleigh	Sargent	Campbell
	Phillips	Cass	Sheridan	Charles Mix
	Pondera	Cavalier	Sioux	Corson
	Richland	Dickey	Stark	Davison
	Roosevelt	Divide	Steele	Douglas
	Sheridan	Dunn	Stutsman	Edmunds
	Toole	Eddy	Towner	Faulk
	Valley	Emmons	Traill	Hand
	Wibaux	Foster	Walsh	Hughes
		Golden Valley	Ward	Hyde
		Grand Forks	Wells	Jerauld
		Grant	Williams	McPherson
		Griggs		Perkins
		Hettinger		Potter
		Kidder		Sanborn
		LaMoure		Spink
		Logan		Sully
		McHenry		Walworth
		McIntosh		Ziebach
		McKenzie		
		McLean		
		Mercer		
		Morton		
		Mountrail		
		Nelson		
		Oliver		
		Pembina		
		Pierce		

Land Resource Region (LRR) – G	COLORADO	MONTANA	NEBRASKA
	Adams	Big Horn	Arthur
	Arapahoe	Carter	Banner
	Bent	Custer	Blaine
	Cheyenne	Dawson	Box Butte
	Crowley	Fallon	Boyd
	Denver	Fergus	Brown
	Elbert	Garfield	Cherry
	Kiowa	Golden Valley	Dawes
	Kit Carson	Musselshell	Garden
	Las Animas	Petroleum	Garfield
	Lincoln	Powder River	Grant
	Morgan	Prairie	Holt
	Otero	Rosebud	Hooker
	Prowers	Treasure	Keya Paha
	Pueblo	Wheatland	Kimball
	Washington	Yellowstone	Knox
	Weld		Logan
			Loup
			McPherson
			Morrill
			Rock
			Scotts Bluff
			Sheridan
			Sioux
			Thomas
			Wheeler

	NEW MEXICO	NORTH DAKOTA	SOUTH DAKOTA	WYOMING
Land Resource Region (LRR) – G	Chaves	Billings	Bennett	Campbell
	De Baca	Bowman	Butte	Converse
	Guadalupe	Slope	Custer	Crook
	Lincoln		Dewey	Goshen
	Mora		Fall River	Johnson
	Quay		Gregory	Laramie
	San Miguel		Haakon	Niobrara
	Santa Fe		Harding	Platte
	Torrance		Jackson	Sheridan
			Jones	Weston
			Lawrence	
			Lyman	
			Meade	
			Mellette	
			Pennington	
			Shannon	
			Stanley	
			Todd	
			Tripp	

Land Resource Region (LRR) – H	COLORADO	KANSAS	KANSAS
	Baca	Barber	McPherson
	Logan	Barton	Meade
	Phillips	Butler	Mitchell
	Sedgwick	Chase	Morris
	Yuma	Cheyenne	Morton
		Clark	Ness
		Clay	Norton
		Cloud	Osage
		Comanche	Osborne
		Cowley	Ottawa
		Decatur	Pawnee
		Dickinson	Phillips
		Edwards	Pottawatomie
		Elk	Pratt
		Ellis	Rawlins
		Ellsworth	Reno
		Finney	Republic
		Ford	Rice
		Geary	Riley
		Gove	Rooks
		Graham	Rush
		Grant	Russell
		Gray	Saline
		Greeley	Scott
		Greenwood	Sedgwick
		Hamilton	Seward
		Harper	Sheridan
		Harvey	Sherman
		Haskell	Smith
		Hodgeman	Stafford
		Jewell	Stanton
		Kearny	Stevens
		Kingman	Sumner
		Kiowa	Thomas
		Lane	Trego
		Lincoln	Wabaunsee
		Logan	Wallace
		Marion	Washington
		Marshall	Wichita

LRR H - Counties that Qualify for Sustainable Rangeland Management Soil Carbon Offsets

	NEBRASKA	NEW MEXICO	OKLAHOMA
Land Resource Region (LRR) – H	Adams	Curry	Alfalfa
	Buffalo	Harding	Beaver
	Butler	Lea	Beckham
	Chase	Roosevelt	Blaine
	Cheyenne	Union	Caddo
	Clay		Canadian
	Custer		Cimarron
	Dawson		Cleveland
	Deuel		Comanche
	Dundy		Cotton
	Fillmore		Custer
	Franklin		Dewey
	Frontier		Ellis
	Furnas		Garfield
	Gosper		Grant
	Greeley		Greer
	Hall		Harmon
	Hamilton		Harper
	Harlan		Jackson
	Hayes		Jefferson
	Hitchcock		Kay
	Howard		Kingfisher
	Jefferson		Kiowa
	Kearney		Logan
	Keith		Major
	Lincoln		McClain
	Merrick		Noble
	Nuckolls		Oklahoma
	Perkins		Pawnee
	Phelps		Payne
	Polk		Roger Mills
	Red Willow		Texas
	Saline		Tillman
	Seward		Washita
	Sherman		Woods
	Thayer		Woodward
	Valley		
	Webster		
	York		

Land Resource Region (LRR) – H	TEXAS	
	Andrews	Hutchinson
	Archer	Jack
	Armstrong	Jones
	Bailey	Kent
	Baylor	King
	Borden	Knox
	Briscoe	Lamb
	Brown	Lipscomb
	Callahan	Lubbock
	Carson	Lynn
	Castro	Martin
	Childress	Midland
	Clay	Mitchell
	Cochran	Montague
	Coke	Moore
	Coleman	Motley
	Collingsworth	Nolan
	Concho	Ochiltree
	Cottle	Oldham
	Crosby	Palo Pinto
	Dallam	Parmer
	Dawson	Potter
	Deaf Smith	Randall
	Dickens	Roberts
	Donley	Runnels
	Ector	Scurry
	Fisher	Shackelford
	Floyd	Sherman
	Foard	Stephens
	Gaines	Stonewall
	Garza	Swisher
	Gray	Taylor
	Hale	Terry
	Hall	Throckmorton
	Hansford	Tom Green
	Hardeman	Wheeler
	Hartley	Wichita
	Haskell	Wilbarger
	Hemphill	Yoakum
	Hockley	Young
	Howard	

Land Resource Region (LRR) – I	TEXAS	
	Atascosa	Kleberg
	Bandera	La Salle
	Bee	Live Oak
	Blanco	Llano
	Brooks	Mason
	Burnet	Maverick
	Cameron	McCulloch
	Comal	McMullen
	Concho	Medina
	Crockett	Menard
	DeWitt	Pecos
	Dimmit	Reagan
	Duval	Real
	Edwards	San Saba
	Frio	Schleicher
	Gillespie	Starr
	Glasscock	Sterling
	Goliad	Sutton
	Hays	Terrell
	Hidalgo	Tom Green
	Irion	Travis
	Jim Hogg	Upton
	Jim Wells	Uvalde
	Karnes	Val Verde
	Kendall	Webb
	Kenedy	Willacy
	Kerr	Zapata
	Kimble	Zavala
	Kinney	

	TEXAS		OKLAHOMA	KANSAS
Land Resource Region (LRR) – J	Austin	Hood	Bryan	Chautauqua
	Bastrop	Hopkins	Carter	
	Bell	Hunt	Cleveland	
	Bexar	Johnson	Creek	
	Bosque	Kaufman	Johnston	
	Brazos	Lamar	Love	
	Burleson	Lampasas	Marshall	
	Caldwell	Lavaca	Murray	
	Collin	Lee	Oklahoma	
	Comanche	Leon	Osage	
	Cooke	Limestone	Pontotoc	
	Coryell	McLennan	Pottawatomie	
	Dallas	Madison	Seminole	
	Delta	Milam	Stephens	
	Denton	Mills		
	Eastland	Navarro		
	Ellis	Parker		
	Erath	Rains		
	Falls	Red River		
	Fannin	Robertson		
	Fayette	Rockwall		
	Franklin	Somervell		
	Freestone	Tarrant		
	Gonzales	Titus		
	Grayson	Van Zandt		
	Guadalupe	Washington		
	Hamilton	Williamson		
	Hill	Wise		

Appendix C – Summary of Soil Carbon Sequestration Research by Land Resource Region

Potential Carbon Sequestration for Sustainable Rangeland Management Practices in LRR C

Description of the California subtropical fruit, truck and specialty crop region (LRR C):[7]

The region is highly variable in both climate and landforms. In particular, elevation changes within this region can have a dramatic impact on Rangeland productivity and the potential for carbon sequestration. Rangelands within this region are found primarily in the Coast Range Mountains (MLRA 15) and Sierra Mountain foothills (MLRA 18). The dominant land use in both of these areas is livestock grazing on Rangelands dominated by annual grasses and forbs. For the purposes of this analysis I used 500 mm (~20") as the average annual precipitation. Precipitation varies from 12" in the Sierra Foothills to as much as 30" in the Coast Range. Year to year variability in precipitation can be high, but effective rainfall is limited to the October-May period.

Potential increased carbon storage:

The primary limit to increasing soil carbon in this region is the seasonality of precipitation. This region is the only Land Resource Region in the U.S. with a true Mediterranean climate (winter rain, summer dry). Although the period of rainfall is relatively reliable, the amount that falls within this period is highly variable and multi-year drought is not unusual. There is little published information in this region on which to base estimates and the seasonal and spatial variability is highly variable based on previous land management practices and precipitation history. However, there is adequate information to make a reasonable estimate of the potential.

Improved grazing management

Improving grazing management via stocking rate adjustments (moderate to light) or improved distribution could be expected to increase soil carbon storage by 0.4 T CO_2/ha/y.

[7] http://www.soilinfo.psu.edu/soil_lrr/lrr.cgi?21,148

Restoring degraded land via grazing management Because of the unique nature of the vegetation, soil and climate interactions in the California Annual Grassland Rangeland Type, Rangelands respond rapidly to changes in management. The dominance of the vegetation by annual plants also tends to reduce changes in productivity in response to management. The balance of grasses and forbs is a better indicator of management status than measures of productivity. Forbs such as filaree (*Erodium cicutarium*) increase in response to heavy grazing, while annual grasses such as *Bromus* spp increase under more moderate stocking. The balance between grasses and forbs can change quickly in response to changes in stocking. A critical determinant of carbon dynamics in this system is not only the amount of rainfall, but the interaction between precipitation and temperature. Cool early season temperatures can limit growth and constrain productivity. Given these unique characteristics of the California Annual Grasslands, it would be unwise to ascribe a different rate of carbon sequestration to restoration than for improved management.

For both categories (restoration, improved management), a readily determined key to achieving success is to implement the recommended practices on land with the Oak tree layer intact. Research has shown that Oak trees have a positive impact on nutrient cycling, productivity and carbon storage in soils beneath and adjacent to them.

<u>Literature:</u>

Dahlgren, R.A., M.J. Singer & X. Huang. 1997. Oak tree and grazing impacts on soil properties and nutrients in a California oak woodland. Biogeochemistry 39:45-64.

Vine, E. 2004. Regulatory constraints to carbon sequestration in terrestrial ecosystems and geologic formations: a California perspective. Mitigation and Adaptation Strategies for Global Change 9: 77–95, 2004.

Xu, L. and D.D. Baldocchi. 2004. Seasonal variation in carbon dioxide exchange over a

Mediterranean annual grassland in California. Agricultural and Forest Meteorology 1232 79–96

Potential Carbon Sequestration for Sustainable Rangeland Management Practices in LRR E

Description of the Rocky Mountain Range and Forest Region (LRR E):[8]

The region is highly variable in both climate and landforms. Rangelands are found primarily in the lower elevations and lower extent of the precipitation range. For the purposes of this analysis I used 500 mm (~20") as the average annual precipitation because that both reflects the conditions for Rangelands in general and in particular for the proposal from the Sun Ranch.

Potential increased carbon storage:

The primary limit to increasing soil carbon in this region is low productivity (low precipitation). There is little published information in this region on which to base estimates and the seasonal and spatial variability is highly variable based on previous land management practices and precipitation history. However, there is adequate information to make a reasonable estimate of the potential.

Improved grazing management

Improving grazing management via stocking rate adjustments (moderate to light) or improved distribution could be expected to increase soil carbon storage by 0.3 T CO_2/ha/y.

Liebeg et al (2005) estimated improved grazing practices could increase soil carbon in this region by about 0.6 T CO_2/ha/y $\pm$ 0.4 across a range of 250 to 760 mm average annual precipitation. Campbell et al (2004) estimated that grazing management in the region could increase soil carbon from 0.18 to 0.48 T CO_2/ha/y. Both of these studies were literature reviews of studies from similar areas and so average across multiple observations. COMET VR simulations for management changes in the area returned values of 0.1 to 0.4 T CO_2/ha/y.

Restoring degraded land via grazing management Implementing dramatic cuts in stocking rate and improved distribution to restore productivity could be expected to increase soil carbon by 0.7 T CO_2/ha/y. This estimate is based on the relationship defined in Conant and Paustian (2002). They surveyed literature globally on the potential of overgrazed Rangelands to increase carbon storage via improved management and developed a regression equation:

[8] http://www.soilinfo.psu.edu/soil_lrr/lrr.cgi?162,148#textinfo

Potential sequestration (T C/ha/y) =
0.00134*Mean Annual Precip (mm) – 0.488.

Solving this equation for 500 mm annual precipitation and converting T C to T CO_2 gives the value of approximately 0.7. COMET VR simulations also returned values of 0.36 to 1.5 T CO_2/ha/y for a range of restoration practices in the region.

Given the twofold difference in these two sequestration rates based entirely on management history, the determination of the initial state is a critical component of accurately determining potential sequestration rate. Without physical evidence of reduced productivity (>50% reductions in average years) or direct measurement of soil carbon (<1% SOM), I would hesitate to assume that the Rangeland was in a degraded initial state.

<u>Literature:</u>

Campbell, S. S. Mooney, J.P. Hewlett, D.J. Menkhaus and G.F. Vance. 2004. Can ranchers slow climate change? Rangelands 26: 16-22.

Conant, R.T. and K. Paustian. 2002. Potential soil carbon sequestration in overgrazed grassland ecosystems. Global Biogeochemical Cycles 16: 803-815.

Liebig, M. J.A. Morgan, J.D. Reeder, B.H. Ellert, H.T. Gollany and G.E. Schuman. 2005. Greenhouse gas contributions and mitigation potential of agricultural practices in northwestern USA and western Canada. Soil and Tillage Research 83: 25-52.

Potential Carbon Sequestration for Sustainable Rangeland Management Practices in LRR F

Description of the Northern Great Plains Spring Wheat (LRR F):[9]

This region of the Great Plains has fertile soils and largely smooth topography favorable for agriculture, but the low precipitation and a short growing season severely limit crops that can be grown. The average annual precipitation ranges from 250 to 550 mm, with most of the precipitation falling during the growing season. For the purposes of this analysis, we used 430 mm (~17") as the average annual precipitation because that reflects the conditions for Rangelands in general.

Potential increased carbon storage:

The primary limit to increasing soil carbon in this region is low productivity (low precipitation). There is limited published information in this region on which to base estimates and the seasonal and spatial variability is highly variable based on previous land management practices and precipitation history. There is adequate information to make a reasonable estimate of the potential.

Improved grazing management

Improving grazing management via stocking rate adjustments (light to moderate) or improved distribution could be expected to increase soil carbon storage by 0.6 T CO_2/ha/y.

Liebeg et al (2005) estimated improved grazing practices could increase soil carbon in this region by about 0.6 T CO_2/ha/y $\pm$ 0.4 across a range of 250 to 760 mm average annual precipitation. Campbell et al (2004) estimated that grazing management in the region could increase soil carbon from 0.18 to 0.48 T CO_2/ha/y. Both of these studies were literature reviews of studies from similar areas and so average across multiple observations. Frank (2004) using CO_2 flux data in a study site near Mandan, ND, reports uptake of about 1.0 CO_2/ha/y. Weinhold et al. (2001) reported moderate grazing increased soil carbon by 19%. COMET VR simulations for management changes in the area returned values of 0.1 to 0.25 T CO_2/ha/y.

Restoring degraded land via grazing management Implementing dramatic cuts in stocking rate and improved distribution to restore productivity could be expected to increase soil carbon by 0.3 T CO_2/ha/y. This estimate is based on the relationship defined in Conant and

[9] http://www.soilinfo.psu.edu/soil_lrr/lrr.cgi?218,40#textinfo

Paustian (2002). They surveyed literature globally on the potential of overgrazed Rangelands to increase carbon storage via improved management and developed a regression equation

Potential sequestration (T C/ha/y) =
0.00134*Mean Annual Precip (mm) – 0.488.

Solving this equation for 430 mm annual precipitation and converting T C to T CO_2 gives the value of approximately 0.3. COMET VR simulations also returned values of 0.1 to 0.35 T CO_2/ha/y for a range of restoration practices in the region.

Literature:

Campbell, S. S. Mooney, J.P. Hewlett, D.J. Menkhaus and G.F. Vance. 2004. Can ranchers slow climate change? Rangelands 26: 16-22.

Conant, R.T. and K. Paustian. 2002. Potential soil carbon sequestration in overgrazed grassland ecosystems. Global Biogeochemical Cycles 16: 803-815.

Frank, A.B. 2004. Six years of CO_2 flux measurements for moderately grazed mixed-grass prairie. Environmental Management 33:S426-S431.

Wienhold, B.J., J.R. Hendrickson, and J.F. Karn. 2001. Pasture management influences soil properties in the Northern Great Plains. Journal of Soil and Water Conservation 56:27-31.

Potential Carbon Sequestration for Sustainable Rangeland Management Practices in LRR G

Description of the Western Great Plains Range and Irrigated Region (LRR G):[10]

This region of the Great Plains is rolling upland and mostly in Rangeland with some dryland wheat farming along with minor irrigated farmland. Soils are underlain by clay shale, siltstone, soft sandstone and (locally) thick alluvium. The average annual precipitation ranges from 275 to 600 mm, but fluctuates widely from year to year. This region encompasses two primary Rangeland ecosystems that differ in dominant species with contrasting photosynthetic pathways and productivity. The northern mixed-grass prairie, located north of the Colorado-Wyoming border and extending north into Montana, is dominated by mid-height perennial C3 (cool-season grasses) with an average productivity of 1500 kg/ha. The shortgrass steppe, located south of the Colorado-Wyoming border and extending south into New Mexico, is dominated by perennial C4 (warm-season) shortgrasses, primarily blue grama (*Bouteloua gracilis*) and buffalograss (*Buchloe dactyloides*), with a lower productivity of 1000 kg/ha. For the purposes of this analysis, we split LLR G into 1) a north (northern mixed-grass prairie) section using 430 mm (~17") as the average annual precipitation because that reflects the conditions for Rangelands in general, and 2) a south (shortgrass steppe) section using 330 mm (~13").

Potential increased carbon storage:

The primary limit to increasing soil carbon in this region is low productivity (low precipitation). There is some published information in this region on which to base estimates and the seasonal and spatial variability is highly variable based on previous land management practices and precipitation history. There is adequate information to make a reasonable estimate of the potential.

North section (Northern mixed-grass prairie)

Improved grazing management

Improving grazing management via stocking rate adjustments (light to moderate) or improved distribution could be expected to increase soil carbon storage by 0.6 T CO_2/ha/y.

Liebeg et al (2005) estimated improved grazing practices could increase soil carbon in this region by about 0.6 T CO_2/ha/y $\pm$ 0.4 across a range of 250 to 760 mm average annual precipitation. Campbell et al (2004) estimated that grazing management in the region could

[10] http://www.soilinfo.psu.edu/soil_lrr/lrr.cgi?192,87#textinfo

increase soil carbon from 0.18 to 0.48 T CO_2/ha/y. Both of these studies were literature reviews of studies from similar areas and so average across multiple observations. Schuman et al. (1999) reported increases of approximately 1.1 CO_2/ha/y. Grazing system (rotation vs. continuous) did not affect soil carbon (Manley et al. 1995). COMET VR simulations for management changes in the area returned values of 0.1 to 0.55 T CO_2/ha/y.

Restoring degraded land via grazing management Implementing dramatic cuts in stocking rate and improved distribution to restore productivity could be expected to increase soil carbon by 0.7 T CO_2/ha/y. This estimate is based on the relationship defined in Conant and Paustian (2002). They surveyed literature globally on the potential of overgrazed Rangelands to increase carbon storage via improved management and developed a regression equation

Potential sequestration (T C/ha/y) =
0.00134*Mean Annual Precip (mm) – 0.488.

Solving this equation for 430 mm annual precipitation and converting T C to T CO_2 gives the value of approximately 0.3. COMET VR simulations also returned values of 0.2 to 0.67 T CO_2/ha/y for a range of restoration practices in the region.

Interseeding of a legume into northern mixed-grass prairie has increased soil carbon by 5.7 T CO_2/ha/y after 3 years, 2.4 T CO_2/ha/y after 14 years, and 1.2 T CO_2/ha/y after 36 years (Mortenson et al. 2004, 2005). However, the legume used in the trials was an introduced species and we do not recommend introducing exotic species into relatively intact native ecosystems to increase soil C.

South section (Shortgrass steppe)

Improved grazing management

Improving grazing management via stocking rate adjustments (light to moderate) or improved distribution could be expected to increase soil carbon storage by 0.3 T CO_2/ha/y.

Campbell et al (2004) estimated that grazing management in the region could increase soil carbon from 0.18 to 0.48 T CO_2/ha/y. This study was literature reviews of studies from similar areas and so average across multiple observations. Derner et al. (1997, 2006) report increases in soil carbon of 0.44 T CO_2/ha/y with moderate grazing. COMET VR simulations for management changes in the area returned values of 0.1 to 0.3 T CO_2/ha/y.

Restoring degraded land via grazing management Implementing dramatic cuts in stocking rate and improved distribution to restore productivity could be expected to increase soil carbon by 0 T CO_2/ha/y. This estimate is based on the relationship defined in Conant and Paustian (2002). They surveyed literature globally on the potential of overgrazed Rangelands to increase carbon storage via improved management and developed a regression equation

Potential sequestration (T C/ha/y) =
0.00134*Mean Annual Precip (mm) – 0.488.

Solving this equation for 330 mm annual precipitation and converting T C to T CO_2 gives the value of approximately 0. COMET VR simulations also returned values of 0.1 to 0.55 T CO_2/ha/y for a range of restoration practices in the region.

<u>Literature:</u>

Conant, R.T. and K. Paustian. 2002. Potential soil carbon sequestration in overgrazed grassland ecosystems. Global Biogeochemical Cycles 16: 803-815.

Derner, J.D., D.D. Briske, and T.W. Boutton. 1997. Does grazing mediate soil carbon and nitrogen accumulation beneath C_4 perennial grasses along an environmental gradient? Plant and Soil 191:147-156.

Derner, J.D., T.W. Boutton, and D.D. Briske. 2006. Grazing and ecosystem carbon storage in the North American Great Plains. Plant and Soil 280:77-90.

Manley, J.T., G.E. Schuman, J.D. Reeder, and R.H. Hart. 1995. Rangeland soil carbon and nitrogen responses to grazing. Journal of Soil and Water Conservation 50:294-298.

Mortenson, M.C., G.E. Schuman, and L.J. Ingram. 2004. Carbon sequestration in Rangelands interseeded with yellow-flowering alfalfa (*Medicago sativa* ssp. *falcata*). Environmental Management 33:S475-S481.

Mortenson, M.C., G.E. Schuman, L.J. Ingram, V. Nayigihugu, and B.W. Hess. 2005. Forage production and quality of a mixed-grass Rangeland interseeded with *Medicago sativa* ssp. *falcata*. Rangeland Ecology and Management 58:505-513.

Schuman, G.E., J.D. Reeder, J.T. Manley, R.H. Hart, and W.A. Manley. 1999. Impact of grazing management on the carbon and nitrogen balance of a mixed-grass Rangeland. Ecological Applications 9:65-71.

Potential Carbon Sequestration for Sustainable Rangeland Management Practices in LRR H

Description of the Central Plains Winter Wheat and Range (LRR H):[11]

This region of the Great Plains has soils, topography and climate more favorable for agriculture than those to the west and north. Cash-grain farming is the major agricultural enterprise on the better soils with wheat the principal crop. Steeply sloping, shallow and sandy soils are use for Rangeland. The average annual precipitation is from 500 to 750 mm, but ranges from 375 to 900 mm with increases from northwest to southeast. For the purposes of this analysis, we used 635 mm (~25") as the average annual precipitation because that reflects the conditions for Rangelands in general.

Potential increased carbon storage:

The primary limit to increasing soil carbon in this region is low productivity (low precipitation). There is limited published information in this region on which to base estimates and the seasonal and spatial variability is highly variable based on previous land management practices and precipitation history. There is adequate information to make a reasonable estimate of the potential.

Improved grazing management

Improving grazing management via stocking rate adjustments (light to moderate) or improved distribution could be expected to increase soil carbon storage by 0.9 T CO_2/ha/y.

Sims and Bradford (2001), using CO2 flux data, report increases in soil carbon of approximately 0.9 T CO_2/ha/y. COMET VR simulations for management changes in the area returned values of 0.1 to 0.5 T CO_2/ha/y**.** Of note, soils with very high amounts of calcium carbonate (limestone) in areas with 25" of precipitation may lose carbon with moderate grazing as shown by Derner et al. (2006)

Restoring degraded land via grazing management Implementing dramatic cuts in stocking rate and improved distribution to restore productivity could be expected to increase soil carbon by 1.3 T CO_2/ha/y. This estimate is based on the relationship defined in Conant and Paustian (2002). They surveyed literature globally on the potential of overgrazed Rangelands to increase carbon storage via improved management and developed a regression equation

[11] http://www.soilinfo.psu.edu/soil_lrr/lrr.cgi?210,173#textinfo

Potential sequestration (T C/ha/y) =
0.00134*Mean Annual Precip (mm) – 0.488.

Solving this equation for 635 mm annual precipitation and converting T C to T CO_2 gives the value of approximately 1.3. COMET VR simulations also returned values of 0.2 to 0.9 T CO_2/ha/y for a range of restoration practices in the region. Also, Gebhart et al. (1994) reported increases in soil carbon on Conservation Reserve Program lands of 3.3 T CO_2/ha/y

<u>Literature:</u>

Conant, R.T. and K. Paustian. 2002. Potential soil carbon sequestration in overgrazed grassland ecosystems. Global Biogeochemical Cycles 16: 803-815.

Derner, J.D., T.W. Boutton, and D.D. Briske. 2006. Grazing and ecosystem carbon storage in the North American Great Plains. Plant and Soil 280:77-90.

Gebhart, D.L., H.B. Johnson, H.S. Mayeux, and H.W. Polley. 1994. The CRP increases soil organic carbon. Journal of Soil and Water Conservation 49:488-499.

Sims, P.L., and J.A. Bradford. 2001. Carbon dioxide fluxes in a Southern Plains prairie. Agricultural and Forest Meteorology 109:117-134.

Potential Carbon Sequestration for Sustainable Rangeland Management Practices in LRR I

Description of the Southwest Plateaus and Plains Range and Cotton Region (LRR-I):[12]

This region is in the warmer part of the southern Great Plains. Moderate precipitation is accompanied by high temperatures, and precipitation effectiveness is low. The average annual precipitation is 500 to 750 mm throughout most of the region, but it ranges from 375 to 900 mm. Generally, much of the precipitation falls in spring and in autumn. The average annual temperature ranges from 16 to 22 C. The freeze-free period ranges from 210 to more than 325 days, increasing in length from north to south. Freeze-free years are common in the extreme southern part of the region.

The major soils belong to the order Aridisols (dry), have an Ustic (dry to moderate) moisture regime or are shallow and poorly formed (Orthents). Soil temperatures generally are Thermic (15-22 C) in the Edwards Plateau and Hyperthermic (> 22 C) in the southern portion of the region. Slopes range from steep to nearly level. Range is the dominant land use in most of this region, but wheat, grain sorghum, and other small grains are common.

Potential for Increased Carbon Storage:

The multiple constraints of poorly developed soils, erratic precipitation and high temperatures limit potential plant growth and make increasing carbon storage via Rangeland management difficult. In addition, vegetation management in the region is confounded by a well-documented history of woody plants increase (generally native shrubs). Ecosystem carbon dynamics in the area have been the subject of some relatively sophisticated scientific investigations that have quantified the complexity of the interaction of human activities and the carbon cycle. Because the presence of shrubs is so pervasive throughout the region, Rangeland ecosystems in the region tend to behave unlike grassland dominated Rangelands. Aboveground carbon, a minor portion of the total pool in Rangelands dominated by grasses, can be as much as half of the total ecosystem carbon in shrub dominated ecosystems.

While the total amount of carbon in shrub-dominated Rangelands may exceed that of similar sites dominated by grasses, there is a question as to whether these shrublands are sustainable. As shrubs increase, ground cover typically declines and soil erosion can accelerate. In addition, biodiversity, hydrology, grazing and other associated values may suffer. Thus, there is an overriding environmental interest in reducing shrub dominance in

[12] http://www.soilinfo.psu.edu/soil_lrr/lrr.cgi?217,258#textinfo

these ecosystems. Managing for increased grass:shrub ratios can also increase soil carbon sustainably. However, it should be noted that removing mature shrubs will reduce total pool of carbon in the ecosystem, at least temporarily. Management should be directed at enhancing soil carbon levels sustainably within the context of acceptable and proven management regimes.

Thus, these crediting rates ignore the effects of management on the carbon in the vegetation and focus on changes in soil carbon compatible with a host of other environmental values. Shrub management with chemicals, mechanical treatments or fire is a relatively common practice throughout this region. However, the anthropogenic disturbance of the shrub layer in these ecosystems is exceedingly complex in terms of the effects on carbon dynamics and all possible combinations are not quantified at a level necessary for crediting. For this reason, we recommend not undertaking significant shrub management practices (herbicide, mechanical, fire) during the five-year life of the agreement.

Conversely, while the increase in shrub cover may result in an increase in total carbon, shrub invasion and increase should not be considered a creditable activity, especially in light of the interpretation that this process is the result of mismanagement and degradation.

Improved grazing management

At low and medium shrub densities, proper grazing management (low to moderate stocking rate and proper distribution) can increase soil carbon by 0.4 T CO_2/ha/y compared to heavier stocking rates and poor response to drought. This estimate is based on results of the COMET VR model runs across the region (0.2 to 0.6 T CO_2/ha/y) and measures of soil carbon change and modeling results (LaCopita research area in Jim Wells County= 0.25 T CO_2/ha/y; see Archer et al 2000).

Restoring degraded land via grazing management Implementing dramatic cuts in stocking rate and improved distribution to restore productivity could be expected to increase soil carbon by 1.0 T CO_2/ha/y. This estimate is based on the relationship defined in Conant and Paustian (2002). They surveyed literature globally on the potential of overgrazed Rangelands to increase carbon storage via improved management and developed a regression equation:

$$\textit{Potential sequestration (T C/ha/y)} = 0.00134 \times \textit{Mean Annual Precip (mm)} - 0.488$$

Solving this equation for 600 mm annual precipitation and converting T C to T CO_2 gives the value of approximately 1.0 T CO_2/ha/y. COMET VR simulations also returned values of 0.6 to 0.9 T CO_2/ha/y for a range of restoration practices in the region.

Literature:

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Potential Carbon Sequestration for Sustainable Rangeland Management Practices in LRR J

Description of the Southwestern Prairies Region (LRR-J):[13]

This region consists of prairies and savannas in eastern Texas, in south-central Oklahoma, and in southeastern Kansas. The average annual precipitation ranges from 625 to 1,150 mm (avg 890 mm or ~ 35"). The average annual temperature ranges from 15 to 22° C, and the freeze-free period is 190 to 280 days.

The soil moisture regime of this region is Ustic (associated with semiarid climates). Alfisols (leached forest soils with a clay subsurface horizon) dominate the upland savannas. The prairies are dominated by Ustolls (grassland soils with high fertility) and Vertisols (clay rich soils that crack and swell). The prairies are intensively farmed. Cotton, grain sorghum, wheat, other feed grains, and hay are important crops. The more sloping savannas are used mainly for grazing.

Elevation ranges from 200 to 500 m across most of the region, but may be as low as 50 m near the coast. Uplands are nearly level to strongly rolling and narrow to moderately broad. Stream valleys are narrow and have steep gradients. Local relief is mostly a few tens of meters, but the large valleys are 50 m or more below the adjacent uplands.

Rangeland vegetation in the area is dominated by tallgrasses (big bluestem, Indian grass, little bluestem, switch grass) on more mesic sites and mixed grasses (sideoats grama, tall grama, paspalums) on more arid sites. Savanna trees are post oak, blackjack oak, mesquite and juniper. Riparian areas can be dominated by eastern forest tree species such as oaks, cottonwoods, hackberry and pecan. Forbs (leguminous and non- leguminous) are common on all sites throughout the region.

Potential for increasing carbon storage on Rangelands in the region:

Common management problems are overgrazing and shrub invasion. Overgrazing typically results from livestock demand in excess of forage supply. Because of the naturally fertile soils, mesic rainfall and grazing tolerant vegetation, sites are relatively resilient and can recover quickly if soil erosion has not permanently affected site potential. Management units (pastures) are relatively small (<200 ha) and water is usually well distributed. Invasive shrubs are generally native species, such as mesquite and juniper, which have increased in response to suspension of the historic fire regime. Managing for increased grass:shrub ratios via herbicides, fire or mechanical techniques can increase soil carbon sustainably. However,

[13] http://www.soilinfo.psu.edu/soil_lrr/lrr.cgi?242,232#textinfo

it should be noted that removing mature shrubs will reduce total pool of carbon in the ecosystem, at least temporarily. Management should be directed at enhancing soil carbon levels sustainably within the context of acceptable and proven management regimes.

Thus, these crediting rates ignore the effects of management on the carbon in the vegetation and focus on changes in soil carbon compatible with a host of other environmental values. For this reason, we recommend not undertaking significant shrub management practices (herbicide, mechanical, fire) during the five-year life of the agreement.

Conversely, while the increase in shrub cover may result in an increase in total carbon, shrub invasion and increase should not be considered a creditable activity, especially in light of the interpretation that this process is the result of mismanagement and degradation and the consistently negative effect on associated environmental variables.

Improved grazing management

The introduction of improved grazing management practices (reduced stocking rate, proper season of use, distribution) can result in the sequestration of 1.0 T CO_2/ha/y.

These estimates of sequestration rates for the region are based on research reports of CO_2 flux (Bowen Ration flux towers) at the Blackland Research Center near Temple in Bell County TX (Frank et al 2001, Dugas et al 1999). While carbon sequestration rates over a five year period were highly variable (0.25 to 2.8 T CO_2/ha/y) and made on long-term ungrazed native range treated with fire, the suggested rates are consistent with other reports in the literature and COMET VR model runs across the region (0.8 to 1.2 T CO_2/ha/y).

Restoring degraded land via grazing management

Because of the consistent and mesic rainfall regime and the relatively fertile soils, it is unlikely that soil carbon depletion would occur with overgrazing beyond the levels discussed above. Thus, the values associated with improved management are also valid here (see Potter and Derner 2006 and Potter et al 1999).

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Appendix D - Drought Monitoring and Classification Reference Information

Drought conditions in the United States are monitored and tracked on the National Drought Monitoring Center (NDMC) website operated by the University of Nebraska at Lincoln. http://www.drought.unl.edu/ The National Drought Map is updated weekly and drought conditions are reported on a county by county basis. Specifically, Verifiers and Aggregators may use the Drought Monitoring tool by county available at the following link to determine the drought status of enrolled Projects:

http://drought.unl.edu/monitor/spi-dailygridded.html

The drought severity classification table below shows the ranges for each indicator for each dryness level using the Standardized Precipitation Index (SPI). The SPI calculation for any location is based on the long-term precipitation record for a desired period. The SPI can be computed for different time scales, can provide early warning of drought and help assess drought severity, and is less complex than some other indicators.

SPI Values	
2.0+	extremely wet
1.5 to 1.99	very wet
1.0 to 1.49	moderately wet
-.99 to .99	near normal
-1.0 to –1.49	moderately dry
-1.5 to –1.99	severely dry
-2 and less	extremely dry

Drought Severity Classification

Category	Description	Possible Impacts	Standardized Precipitation Index (SPI)
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	-0.5 to -0.7
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested	-0.8 to -1.2
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-1.3 to -1.5 (Light Orange on Color Scale)
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-1.6 to -1.9 (Dark Orange on Color Scale)
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-2.0 or less (Dark Red, Red, Bright Red on Color Scale)
http://www.drought.unl.edu/dm/classify.htm			